
Sandia National Laboratories, New Mexico

Discharge Permit DP-1845 Quarterly Report

October – December 2017

April 2018



United States Department of Energy
Sandia Field Office

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DISCHARGE PERMIT DP-1845 QUARTERLY REPORT

SANDIA NATIONAL LABORATORIES, NEW MEXICO

April 2018

REPORTING PERIOD: October – December 2017

FACILITY INFORMATION

Facility Name: U.S. Department of Energy/National Nuclear Security
Administration (DOE/NNSA)
Discharge Permit Number: DP-1845
Legally Responsible Party: James W. Todd, Assistant Manager for Engineering
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PERMIT INFORMATION

Discharge Permit Issued: May 30, 2017
Discharge Permit Term Ends: May 30, 2022
Permitted Discharge Volume: 20,000 gallons per day
Permit Contact Information: Ground Water Quality Bureau (GWQB)
New Mexico Environment Department (NMED)
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OVERVIEW

Discharge Permit (DP)-1845 was issued by the New Mexico Environment (NMED) Ground Water Quality Bureau (GWQB) for discharges via up to three injection wells in a phased Treatability Study of in-situ bioremediation of groundwater at Sandia National Laboratories, New Mexico, Technical Area-V Groundwater Area of Concern. This report fulfills the quarterly reporting requirements set forth in DP-1845, Section IV.B, Monitoring and Reporting. This reporting period is October 1st through December 31st, 2017. The report is due to NMED GWQB by May 1st, 2018.

ABBREVIATIONS AND ACRONYMS

AOC	Area of Concern
CY	Calendar Year
DOE	U.S. Department of Energy
DP-1845	Discharge Permit-1845
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration Operations
GWQB	Ground Water Quality Bureau
HWB	Hazardous Waste Bureau
INJ	injection (acronym used for well identification only)
ISB	in-situ bioremediation
LWDS	liquid waste disposal system (acronym used for well identification only)
MCL	maximum contaminant level
MW	monitoring well (acronym used for well identification only)
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
SNL/NM	Sandia National Laboratories, New Mexico
TA	Technical Area
TAV	Technical Area-V (acronym used for well identification only)
TA-V	Technical Area-V
TAVG	Technical Area-V Groundwater
TCE	trichloroethene
TS/IM	Treatability Study/Interim Measure
TSWP	Treatability Study Work Plan

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1.0 Introduction

Trichloroethene (TCE) and nitrate have been identified as constituents of concern in groundwater at the Sandia National Laboratories, New Mexico (SNL/NM) Technical Area (TA)-V Groundwater (TAVG) Area of Concern (AOC) based on detections above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) in samples collected from monitoring wells. The EPA MCLs and the State of New Mexico drinking water standards for TCE and nitrate are 5 micrograms per liter and 10 milligrams per liter (as nitrogen), respectively.

A phased Treatability Study/Interim Measure (TS/IM) of in-situ bioremediation (ISB) is being implemented to evaluate the effectiveness of ISB as a potential technology to treat the groundwater contamination at TAVG AOC (New Mexico Environment Department [NMED] April 2016). The NMED Hazardous Waste Bureau (HWB) approved the Revised Treatability Study Work Plan (TSWP) (SNL/NM March 2016) in May 2016 (NMED May 2016). The SNL/NM Environmental Restoration Operations (ER) personnel are responsible for implementing the TS/IM of ISB at TAVG AOC in accordance with the Revised TSWP.

Per the Revised TSWP, up to three injection wells (TAV-INJ1, TAV-INJ2, and TAV-INJ3) will be installed at TA-V in the vicinity of the highest contaminant concentrations detected in groundwater at monitoring wells LWDS-MW1, TAV-MW6, and TAV-MW10. The proposed injection wells will be used to gravity-inject substrate solution and biodegradation bacteria to groundwater. The substrate solution consists of an inert tracer as well as essential food and nutrients for biostimulation. The substrate solution will be prepared in aboveground tanks. The TS/IM will be conducted in two phases: Phase I includes a pilot test followed by a full-scale injection at the first injection well; Phase II includes full-scale injections at the second and third injection wells.

The NMED Ground Water Quality Bureau (GWQB) requires a groundwater Discharge Permit (DP) for the operation of TA-V Treatability Study injection wells. NMED GWQB issued the final DP-1845 to the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) for the SNL/NM TA-V Treatability Study injection wells on May 26, 2017 (NMED May 2017). The DP-1845 term started on May 30, 2017 and ends on May 30, 2022. Attachment A provides a copy of the final DP-1845.

2.0 **DP-1845 Quarterly Operational Activities, October – December 2017**

This section describes the operational activities that occurred during the October 1st to December 31st, 2017 reporting period. Operations were conducted in compliance with DP-1845 requirements during this reporting period. The Terms and Conditions under *Operation Conditions* in DP-1845, Section IV.A are repeated verbatim, followed by DOE/NNSA and SNL/NM personnel responses.

2.1 **DP-1845 Terms and Conditions #3**

Prior to commencing injection activities, the permittee shall demonstrate the mechanical integrity of the aboveground distribution piping and injection wellheads associated with this Discharge Permit. Prior to testing, the permittee shall propose for NMED approval the test method to be used. The results of the mechanical integrity testing shall be submitted to NMED within 30 days of test completion and prior to injection.

The permittee shall demonstrate mechanical integrity of the aboveground distribution piping and injection wellheads associated with this Discharge Permit at least once every five years. If the distribution piping or an injection wellhead is reconfigured, the permittee must conduct a mechanical integrity test prior to re-injection of effluent into the subsurface at that well.

DOE/NNSA and SNL/NM Personnel Response: The Aboveground Injection System (AIS) Construction and Mechanical Integrity Test Plan (SNL/NM October 2017) was submitted to NMED GWQB on October 12, 2017 (DOE October 2017). NMED GWQB approved the AIS Construction and Mechanical Integrity Test Plan via email on October 26, 2017 (NMED October 2017).

The AIS construction was completed in October 2017. The mechanical integrity test of the AIS was conducted on November 1, 2017. The mechanical integrity test field results were submitted to the NMED GWQB on November 15, 2017, indicating the test results were satisfactory and the AIS was adequate for field deployment for groundwater discharge (DOE November 2017). A formal report will be submitted to the NMED GWQB by January 26, 2018, along with the AIS As-Built Engineering Drawings (SNL/NM December 2017).

2.2 **DP-1845 Terms and Conditions #4**

The permittee is authorized to install and operate not more than three Class V UIC wells. Initial discharge (Phase 1) shall be to TAV-INJ 1 for a pilot test followed by a full-scale

implementation of the treatment system. Phase 2 is proposed to include the addition of UIC wells TAV-INJ 2 and TAV-INJ 3 for full-scale implementation of the treatment system.

DOE/NNSA and SNL/NM Personnel Response: Completed the installation of the first injection well TAV-INJ1 in October 2017. Initial discharge occurred at well TAV-INJ1 for the Phase I pilot test during this reporting period. Section 3.0 provides details on the pilot test.

2.3 **DP-1845 Terms and Conditions #5**

Prior to the first discharge from the system to any of the injection wells, the permittee shall submit written notification to NMED stating the date that the discharge is to commence.

DOE/NNSA and SNL/NM Personnel Response: Notified the NMED GWQB in writing on November 15, 2017 that discharge would commence on November 20, 2017 (DOE November 2017). The pilot test started on November 20, 2017 at injection well TAV-INJ1 and two nearby monitoring wells TAV-MW6 and TAV-MW7. Figure 1 shows the site layout of the pilot test. Photograph 1 in Appendix A shows the system ready for discharge/injection. Pilot test injections were completed on November 27, 2017. Section 3.0 provides more details on the pilot test injections.

2.4 **DP-1845 Terms and Conditions #6**

The permittee shall ensure that the injection treatment facility is secured to control access by the public.

DOE/NNSA and SNL/NM Personnel Response: The AIS and the injection well TAV-INJ1 are located within TA-V, a fenced and DOE access-controlled facility that is not accessible to the public or general workforce at SNL/NM or Kirtland Air Force Base. Orange snow fencing has been installed around the perimeter of the injection system to clearly indicate areas where access is not permitted by unauthorized personnel.

2.5 **DP-1845 Terms and Conditions #7**

The permittee shall maintain signs in English and Spanish (unless otherwise prohibited by policy) at appropriate locations indicating that the effluent may not be potable. Signs shall be posted at the UIC wellheads, at any associated storage vessels, and at any other area where there is potential for persons to contact associated materials or equipment.

DOE/NNSA and SNL/NM Personnel Response: Signs in English and Spanish are posted on each of the two aboveground tanks (Appendix A, Photographs 2, 3, and 4) and at the TAV-INJ1 wellhead (Photograph 5) to indicate that the effluent is not potable.

2.6 **DP-1845 Terms and Conditions #8**

The permittee shall ensure that the Class V UIC wells include monitoring devices, i.e., water level and pressure head transducers, to prevent overfilling of the well.

DOE/NNSA and SNL/NM Personnel Response: During injection, the water level in the well was monitored continuously by field personnel using a pressure transducer installed beneath the static water table in the injection well. Injection rates were controlled manually using the aboveground control valve, and were maintained at a rate sufficiently low to prevent the water level in the injection well casing from rising more than 335 feet above the static water level. This water rise threshold is approximately 175 feet below ground surface.

3.0 **DP-1845 Quarterly Monitoring and Reporting, October – December 2017**

This section responds to the monitoring and reporting requirements in DP-1845, Section IV.B. The Terms and Conditions are repeated verbatim, followed by DOE/NNSA and SNL/NM personnel responses that discuss relevant activities completed during the October 1st to December 31st, 2017 reporting period.

3.1 **DP-1845 Terms and Conditions #10**

METHODOLOGY – Unless otherwise approved in writing by NMED, the permittee shall conduct sampling and analysis in accordance with the most recent edition of the following documents.

- a) Americans Public Health Association, Standard Methods for the Examination of Water and Wastewater (18th, 19th or current);*
- b) U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Waste;*
- c) U.S. Geological Survey, Techniques for Water Resource Investigations of the U.S. Geological Survey;*

- d) *American Society for Testing and Materials, Annual Book of ASTM Standards, Part 31. Water;*
- e) *U.S. Geological Survey, et al., National Handbook of Recommended Methods for Water Data Acquisition;*
- f) *Federal Register, latest methods published for monitoring pursuant to Resource Conservation and Recovery Act regulations; and*
- g) *American Society of Agronomy, Chemical Methods: Methods of Soil Analysis; Part 1. Physical and Mineralogical Methods; Part 2. Microbiological and Biochemical Properties; Part 3.*

DOE/NNSA and SNL/NM Personnel Response: Groundwater sampling activities are performed by in accordance with procedures that are consistent with the EPA's Technical Enforcement Guidance Document (EPA 1986). Groundwater samples were analyzed by offsite laboratories using EPA-specified protocols, except for microbial gene analysis by SiREM and low-level biological indicator gases (methane, ethane, and ethene) analysis by Pace Analytical Energy Services LLC. Table 1 summarizes the analyses, analytical methods, and analytical laboratories used during the pilot test. More details on the field methods and measurements, and quality control procedures for groundwater sampling and analysis are provided in Chapter 1 Sections 1.2 and 1.3 of the Annual Groundwater Monitoring Report (SNL/NM June 2017).

Table 1
Analyses, Analytical Methods, and Analytical Laboratories

Analyses	Analytical Method	Analytical Laboratory
Alkalinity (total, bicarbonate, and carbonate)	SM 2320B	GEL
Ammonia as nitrogen	EPA 350.1	GEL
Anions (Bromide, Chloride, Fluoride, Nitrite, Orthophosphate as phosphorus, Sulfate)	SW846 9056	GEL
Dissolved Metals (Arsenic, Calcium, Iron, Magnesium, Manganese, Potassium, Sodium)	SW846 3005/6020	GEL
MEE (methane, ethane, and ethene)	AM20GAX	PACE
Microbial (<i>Dehalococcoides</i>)	Gene-Trac Dhc	SiREM
Nitrate/Nitrite (nitrate plus nitrite as nitrogen)	EPA 353.2	GEL
Sulfide (reactive releasable sulfide)	SW846 Chapter 7.3.4	GEL
Total Organic Carbon	SW846 9060A	GEL
Volatile Organic Compounds	SW846 8260B	GEL

Notes

Dhc = *Dehalococcoides*.
GEL = GEL Laboratories LLC, 2040 Savage Rd, Charleston, SC 29407.
PACE = Pace Analytical Energy Services LLC, 220 William Pitt Way, Pittsburgh, PA 15238.
SiREM = SiREM, 130 Stone Rd. W, Guelph, Ontario, N1G 3Z2, Canada.

3.2 **DP-1845 Terms and Conditions #11**

The quarterly reports shall document the influent and discharge volumes from the treatment systems, quarterly groundwater and effluent sampling results, and any operations/maintenance activities performed for the prior quarter.

Quarterly monitoring shall be performed during the following periods and submitted as follows.

- *January 1st through March 31st (first quarter) – due by August 1st;*
- *April 1st through June 30th (second quarter) – due by November 1st;*
- *July 1st through September 30th (third quarter) – due by February 1st; and*
- *October 1st through December 31st (fourth quarter) – due by May 1st.*

DOE/NNSA and SNL/NM Personnel Response: Terms and Conditions #11 is broken into the following sub-requirements:

- a) Quarterly influent and effluent volumes,
- b) Quarterly groundwater and effluent sampling results,
- c) Operation/maintenance activities performed during the quarter, if any, and
- d) Submittal of Quarterly Report.

a) Treatment system influent is comprised of potable water conveyed directly from a fire hydrant to two 5,000-gallon poly tanks, as shown in Appendix A, Photograph 1. The influent (potable water) is mixed with various chemicals to prepare treatment solution and stored in the aboveground tanks, which is discharged or injected into groundwater. The solution discharged from the tanks and injected into the ground is the effluent permitted under DP-1845. The terms effluent, discharge, and injectate are synonymous in this report.

Influent was delivered to the tanks on November 20, 2017. Both tanks were filled with 4,500-gallons (9,000 gallons total) potable water. Influent volume was measured using a totalizing flow meter.

The pilot test injections were conducted between November 21 and November 27, 2017. Effluent was discharged in two injection events on three separate days: the first injection was conducted over the course of two days (November 21-22, 2017) and did not contain KB-1 dechlorinator (the dechlorinating bacteria purchased through SiREM); the second injection was conducted on November 27 and contained KB-1 dechlorinator. Table 2 provides the influent and discharge volumes from the system in the fourth quarter of Calendar Year 2017 (CY2017Q4).

Table 2
Quarterly Influent and Effluent Volumes

CY2017Q4	Influent Volume (gal)	Effluent Volume (gal)
October 2017	0	0
November 2017	9,000	8,782 ^a
December 2017	0	0

Notes

^a Residue of treatment solution (estimated 218 gallons total) was saved in the aboveground tanks for next phase of the project.
gal = Gallon.

b) Groundwater sampling at injection well TAV-INJ1 started on November 28, 2017, the day after the final pilot test injection was complete. The effluent is the treatment solution in aboveground tanks and the monitoring requirements are being implemented at the discharge point, i.e., groundwater at injection well TAV-INJ1. Six sampling events were conducted at well TAV-INJ1 in CY2017Q4. Table B-1 in Appendix B provides the groundwater sampling results at well TAV-INJ1 in CY2017Q4.

No results exceeded the groundwater standards specified in 20.6.2.3103 New Mexico Administrative Code (NMAC), except for arsenic, iron, and manganese (Table B-1). These results exceeded respective groundwater standards, which was expected for the ISB process (SNL/NM March 2016, Section 3.0). During ISB, the injected treatment solution depletes the aquifer of dissolved oxygen and lowers the oxidation-reduction potential. This produces conditions conducive to anaerobic degradation of TCE and nitrate at TAVG AOC. The process of developing strongly anaerobic redox conditions would result in solubilization and mobilization of naturally occurring oxidized metals and metalloids, as observed at well TAV-INJ1 for arsenic, iron, and manganese. However, the solubilization of these metals is a transient phenomenon and is limited to the treatment area. Solubilized metals and metalloids will precipitate into solid form once they leave the anaerobic treatment zone, and their concentrations will return to baseline levels, as demonstrated by the groundwater sampling results at monitoring wells TAV-MW6 and TAV-MW7 (see Section 3.8).

c) Operation activities comprised two injections as described in response to part a). After the completion of the pilot test injections, the entire AIS assembly was drained and stored offsite. The two 5,000-gallon tanks remained at the project site. The wellhead of TAV-INJ1 is covered with a traffic-grade manhole cover. The project site is secured with fence and traffic barriers.

d) This Quarterly Report addresses the reporting period of October 1st through December 31st, 2017. This is the second quarterly report after DP-1845 was issued in May 2017.

3.3 **DP-1845 Terms and Conditions #12**

Quarterly reports shall include the following general information:

- a) any periodic test of mechanical integrity conducted;*
- b) any replacement of primary or secondary vessels or associated treatment system infrastructure with an accompanying narrative explanation of the reasons for the decision to replace the vessels;*
- c) any well work-overs conducted; and*
- d) any additional operation changes with the potential to markedly affect the discharge.*

DOE/NNSA and SNL/NM Personnel Response:

- a) A mechanical integrity test of the AIS was conducted on November 1, 2017 (see details in Section 2.1). No periodic test of mechanical integrity was necessary or required during the pilot test.
- b) No replacement of primary or secondary vessels or associated treatment system infrastructure was necessary or required during the pilot test.
- c) No well work-overs were necessary or required during the pilot test.
- d) No operation changes occurred during the pilot test that would markedly affect the discharge.

3.4 **DP-1845 Terms and Conditions #13**

Quarterly reports shall include the following system performance information:

- a) monthly average, maximum, and minimum values for flow rate and volume of effluent transferred to each injection well;*
- b) the totalized monthly volume of effluent transferred to each injection well;*
- c) monthly average, maximum, and minimum values of injection water level (pressure head) above static level for each injection well; and*
- d) the volume pumped from each extraction well.*

Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations.

DOE/NNSA and SNL/NM Personnel Response:

- a) Table 3 provides the monthly average, maximum, and minimum values for flow rate and volume of effluent transferred to well TAV-INJ1 in CY2017Q4.

Table 3
Flow Rate and Volume of Effluent Transferred to Well TAV-INJ1

Flow Rate (gpm)			Daily Volume (gpd)			Total Volume (gal)
Average ^a	Maximum ^a	Minimum ^a	Average ^a	Maximum ^a	Minimum ^a	
October						
0	0	0	0	0	0	0
November						
16.0	25.5	3.2	2311	4,365	2,000	8,782
December						
0	0	0	0	0	0	0

Notes

^aAverage, maximum, and minimum values for flow rate and volume of effluent represent periods when injection system was in operation (November 21, 22, and 27, 2017).

gpm = Gallon per minute.

gpd = Gallon per day.

gal = Gallon.

- b) The totalized volume of effluent transferred to well TAV-INJ1 in this quarter was 8,782 gallons.
- c) Table 4 provides the monthly average, maximum, and minimum values of water level above static level during injections at well TAV-INJ1. The maximum water level rise in well TAV-INJ1 was 302.6 feet above static level, which is approximately 207 feet below ground surface. The water level returned to near the static level within a few hours after injection was discontinued.

Table 4
Water Levels Above Static Level at Well TAV-INJ1

October			November			December		
Average ^a (feet)	Maximum ^a (feet)	Minimum ^a (feet)	Average ^a (feet)	Maximum ^a (feet)	Minimum ^a (feet)	Average ^a (feet)	Maximum ^a (feet)	Minimum ^a (feet)
0	0	0	245.1	302.6	26.2	0	0	0

Notes

^aAverage, maximum, and minimum values for water levels represent periods when injection system was in operation (November 21, 22, and 27, 2017).

- d) No groundwater was extracted from well TAV-INJ1 for use in preparing treatment solution (effluent) during the pilot test; potable water (influent) was used instead.

A dedicated flow meter (Neptune 2" T-10 Positive Displacement Meter, Lead Free Bronze) was used to monitor effluent volumes injected at well TAV-INJ1. The flow meter was calibrated by the manufacturer and inspected before use.

3.5 **DP-1845 Terms and Conditions #14**

The permittee shall develop a groundwater elevation contour map on a quarterly basis using the top of casing elevation data and quarterly depth-to-most-shallow groundwater measurements obtained from the groundwater monitoring wells required by this Discharge Permit.

The groundwater elevation contour map shall depict the groundwater flow direction based on the groundwater elevation contours. Groundwater elevations between monitoring well locations shall be estimated using common interpolation methods. A contour interval appropriate to the data shall be used, but in no case shall the interval be greater than two feet. Groundwater elevation contour maps shall depict the groundwater flow direction, using arrows, based on the orientation of the groundwater elevation contours, and the location and identification of each monitoring well and contaminant source. The groundwater elevation contour map shall be submitted to NMED in the quarterly monitoring reports.

DOE/NNSA and SNL/NM Personnel Response: A groundwater elevation contour map is shown in Figure 2. The most recent groundwater elevations for the entire well network were measured in October 2017. Also shown (in red) are the groundwater elevations at wells TAV-INJ1, TAV-MW6, and TAV-MW7 from December 2017 after the pilot test injections were completed. The December 2017 groundwater elevations for the three wells were very similar to the elevations before the injections. Water level rise was observed in wells TAV-INJ1 and TAV-MW6 during injection; these wells are screened across the groundwater table and are approximately 50 feet apart. The water level rise in both wells subsided to the static level shortly after injection was discontinued. Water level rise was not observed in well TAV-MW7, which is screened approximately 90 feet below the groundwater table and located approximately 30 feet away from well TAV-INJ1. The pilot test injections had no long-term impact on the potentiometric surface contours at the site.

Note that the groundwater elevation at the newly installed TAV-INJ1 is only an approximation. The well survey for TAV-INJ1 is pending; therefore, the measuring point elevation for TAV-INJ1 is not yet available. The measuring point elevation at nearby well

TAV-MW7 was used to calculate the estimated groundwater elevation at TAV-INJ1 as shown in Figure 2.

3.6 **DP-1845 Terms and Conditions #15**

NMED shall have the option to perform downhole inspections of all monitoring and UIC wells identified in this Discharge Permit. NMED shall establish the inspection data and provide at least a 60-day notice to the permittee by certified mail. The permittee shall have any existing dedicated pumps removed at least 48 hours prior to NMED inspection to allow adequate settling time of sediment agitated from pump removal.

Should a facility not have existing dedicated pumps, but decide to install pumps in any of the monitoring wells, NMED shall be notified at least 90 days prior to pump installation so that a downhole well inspection(s) can be scheduled prior to pump replacement.

All confirmation analysis will be conducted by an independent environmental laboratory that is certified under the National Environmental Laboratory Accreditation Program.

DOE/NNSA and SNL/NM Personnel Response: All wells associated with this Discharge Permit are available for inspection by NMED GWQB. No inspections were requested or conducted by NMED GWQB during this reporting period. No confirmation sampling was requested or conducted by NMED GWQB during this reporting period.

3.7 **DP-1845 Terms and Conditions #16**

Groundwater samples shall be collected from each new injection well and associated monitoring well prior to discharge, and analyzed for the constituents listed below to establish baseline conditions prior to substrate injection.

- *Alkalinity (total, bicarbonate and carbonate)*
- *Ammonia (as nitrogen)*
- *Anions (bromide, chloride, fluoride, nitrite and sulfate)*
- *Dehalococcoides*
- *Dissolved metals (arsenic, calcium, iron, magnesium, manganese, potassium, sodium)*
- *Methane/ethane*
- *Nitrate as nitrogen*
- *Nitrite as nitrogen*
- *Nitrate plus nitrite (as nitrogen)*
- *Orthophosphate (as phosphorus)*
- *Total organic carbon*

- Sulfide
- Volatile organic compounds

Field parameters pH, specific conductivity, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential shall be collected.

DOE/NNSA and SNL/NM Personnel Response: Groundwater baseline samples for all the analytes listed above were collected from injection well TAV-INJ and associated monitoring wells TAV-MW6 and TAV-MW7 prior to the first discharge at well TAV-INJ1. Table B-2 in Appendix B provides the analytical results of the baseline sampling. Table B-3 in Appendix B provides the field parameters measured during the baseline sampling.

3.8 **DP-1845 Terms and Conditions #17**

The permittee shall monitor the groundwater wells TAV-MW6, TAV-MW7, TAV-MW10, and LWDS-MW1 quarterly to determine any change to aquifer chemistry and aquifer flow direction that may be the result of injection.

This quarterly monitoring shall include analysis for the following analytes:

- TCE
- Nitrate as nitrogen
- Nitrite as nitrogen
- Nitrate plus nitrite (as nitrogen)
- Arsenic
- Iron
- Manganese
- cis-1,2-DCE
- Vinyl chloride
- Ethene

Annual sampling will include general chemistry, radiological screening parameters, and total metals as proposed by the permittee to supplement waste characterization requirements and as required under the SNL Compliance Order on Consent.

If the chemical quality of the groundwater being injected changes over time, NMED may require the permittee to conduct geochemical modeling to predict the interaction between the injection fluid and receiving groundwater. Results of all geochemical modeling shall be provided to NMED and shall include predictions on any changes to aquifer porosity and hydraulic conductivity that may result from mineral precipitation or dissolution.

DOE/NNSA and SNL/NM Personnel Response: Two sampling events each were conducted at monitoring wells TAV-MW6 and TAV-MW7 in CY2017Q4. Table B-4 in Appendix B provides the DP-1845-required groundwater sampling results for the analytes listed above at wells TAV-MW6 and TAV-MW7 in CY2017Q4. Nitrate as nitrogen was not separately measured as nitrate results can be derived from nitrite as nitrogen and nitrate plus nitrite (as nitrogen) results. As indicated in Tables B-2 and B-4, a negligible amount of nitrite presents at TAVG AOC. Groundwater sampling results at wells TAV-MW6 and TAV-MW7 after pilot test injections are comparable to their respective baseline levels presented in Table B-2.

Wells TAV-MW10 and LWDS-MW1 are not part of the Treatability Study at injection well TAV-INJ1. The pilot test and potential full-scale test injections at well TAV-INJ1 are not expected to have any impact on wells TAV-MW10 and LWDS-MW1. Those wells are associated with the full-scale injections at the proposed injection wells TAV-INJ2 and TAV-INJ3 in Phase II of the Treatability Study (see Section 1.0). Groundwater sampling results of wells TAV-MW10 and LWDS-MW1 will be reported to the NMED GWQB in conjunction with the Treatability Study at wells TAV-INJ2 and TAV-INJ3, when implemented.

The requirement for annual sampling that includes general chemistry, radiological screening parameters, and total metals to supplement waste characterization requirements became inapplicable, per the verbal notification by the Albuquerque Bernalillo County Water Utility Authority that remediation water cannot be discharged to the city sewer system. Currently, the wastewater generated in groundwater sampling process is being managed at the SNL/NM Hazardous Waste Handling Unit and shipped offsite for proper disposal in compliance with applicable regulatory requirements.

4.0 **References**

DOE, see U.S. Department of Energy.

New Mexico Environment Department (NMED), April 2016. Letter to J.P. Harrell (U.S. Department of Energy, NNSA/Sandia Field Office) and M.W. Hazen (Sandia National Laboratories, New Mexico), "Summary of Agreements and Proposed Milestones Pursuant to the Meeting of July 20, 2015, March 30, 2016, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-16-MISC," NMED, Hazardous Waste Bureau, Santa Fe, New Mexico, April 14, 2016.

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Figures

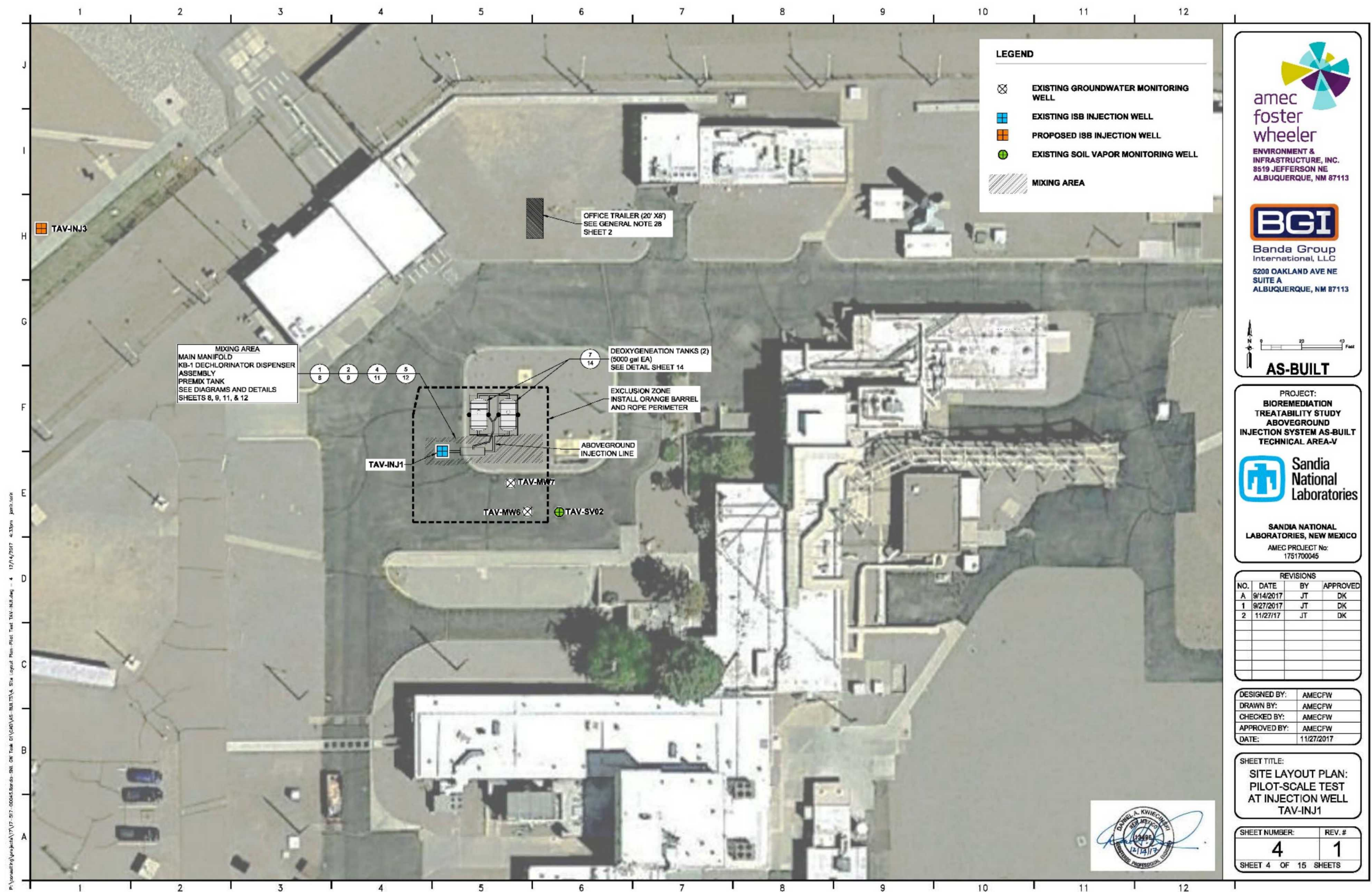


Figure 1
Site Layout Plan: Pilot-Scale Test at Injection Well TAV-INJ1
 (SNL/NM December 2017, Sheet 4 of AIS As-Built Drawings)

Appendix A

Pilot Test Photographs

Note: Photographs are obscured in the background per the corporate requirement of Sandia National Laboratories.



Photograph 1. Pilot Test System Set up on November 20, 2017, view is toward the northeast



Photograph 2. Signs on Aboveground Tank, view is toward the east



Photograph 3. Signs on Aboveground Tank, view is toward the east



Photograph 4. Signs on Aboveground Tank, view is toward the west



Photograph 5. Sign at TAV-INJ1 Wellhead, view is toward the northeast

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Appendix B

Analytical Results Tables

Table B-1
Analytical Results of Groundwater Sampling at Well TAV-INJ1

Sample Date	Analyte ^a	Result ^b	MDL ^c	PQL ^d	Units	Groundwater Standard ^e	Lab Qualifier ^f	Validation Qualifier ^g	Sample No.	Analytical Method ^h	Lab ⁱ
TAV-INJ1											
6-Dec-17	Trichloroethene	0.31	0.3	1	µg/L	0.1 mg/L	J		104097-001	SW846 8260B	GEL
11-Dec-17	Trichloroethene	0.35	0.3	1	µg/L	0.1 mg/L	J		104156-001	SW846 8260B	GEL
28-Nov-17	Nitrite	ND	0.66	2	mg/L	NE	U		104104-006	SW846 9056	GEL
29-Nov-17	Nitrite	ND	3.3	10	mg/L	NE	U		104106-006	SW846 9056	GEL
1-Dec-17	Nitrite	ND	16.5	50	mg/L	NE	U		104108-006	SW846 9056	GEL
6-Dec-17	Nitrite	ND	16.5	50	mg/L	NE	UH	UJ	104097-006	SW846 9056	GEL
11-Dec-17	Nitrite	ND	16.5	50	mg/L	NE	U	UJ	104156-006	SW846 9056	GEL
19-Dec-17	Nitrite	ND	0.66	2	mg/L	NE	U	UJ	104178-006	SW846 9056	GEL
28-Nov-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U	UJ	104104-007	EPA 353.2	GEL
29-Nov-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U	UJ	104106-007	EPA 353.2	GEL
1-Dec-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U		104108-007	EPA 353.2	GEL
6-Dec-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U		104097-007	EPA 353.2	GEL
11-Dec-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U		104156-007	EPA 353.2	GEL
19-Dec-17	Nitrate plus nitrite as N	ND	0.017	0.05	mg/L	10.0 mg/L	U		104178-007	EPA 353.2	GEL
28-Nov-17	Arsenic	0.0412	0.002	0.005	mg/L	0.1 mg/L			104104-010	SW846 3005/6020	GEL
29-Nov-17	Arsenic	0.0326	0.002	0.005	mg/L	0.1 mg/L			104106-010	SW846 3005/6020	GEL
1-Dec-17	Arsenic	0.0607	0.002	0.005	mg/L	0.1 mg/L			104108-010	SW846 3005/6020	GEL
6-Dec-17	Arsenic	0.0983	0.002	0.005	mg/L	0.1 mg/L			104097-010	SW846 3005/6020	GEL
11-Dec-17	Arsenic	0.108	0.002	0.005	mg/L	0.1 mg/L			104156-010	SW846 3005/6020	GEL
19-Dec-17	Arsenic	0.147	0.002	0.005	mg/L	0.1 mg/L			104178-010	SW846 3005/6020	GEL
28-Nov-17	Iron	0.891	0.033	0.1	mg/L	1.0 mg/L			104104-010	SW846 3005/6020	GEL
29-Nov-17	Iron	0.723	0.033	0.1	mg/L	1.0 mg/L			104106-010	SW846 3005/6020	GEL
1-Dec-17	Iron	0.911	0.033	0.1	mg/L	1.0 mg/L			104108-010	SW846 3005/6020	GEL
6-Dec-17	Iron	0.974	0.033	0.1	mg/L	1.0 mg/L			104097-010	SW846 3005/6020	GEL
11-Dec-17	Iron	0.906	0.033	0.1	mg/L	1.0 mg/L			104156-010	SW846 3005/6020	GEL
19-Dec-17	Iron	1.43	0.033	0.1	mg/L	1.0 mg/L			104178-010	SW846 3005/6020	GEL
28-Nov-17	Manganese	0.87	0.001	0.005	mg/L	0.2 mg/L			104104-010	SW846 3005/6020	GEL
29-Nov-17	Manganese	0.913	0.001	0.005	mg/L	0.2 mg/L			104106-010	SW846 3005/6020	GEL
1-Dec-17	Manganese	1.28	0.005	0.025	mg/L	0.2 mg/L			104108-010	SW846 3005/6020	GEL
6-Dec-17	Manganese	3.27	0.01	0.05	mg/L	0.2 mg/L		J	104097-010	SW846 3005/6020	GEL
11-Dec-17	Manganese	5.02	0.01	0.05	mg/L	0.2 mg/L		J	104156-010	SW846 3005/6020	GEL
19-Dec-17	Manganese	7.62	0.01	0.05	mg/L	0.2 mg/L		J	104178-010	SW846 3005/6020	GEL
28-Nov-17	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104137-001	AM20GAX	PACE
29-Nov-17	Ethene	0.13	0.005	0.1	µg/L	NE		J	104139-001	AM20GAX	PACE
1-Dec-17	Ethene	0.17	0.005	0.1	µg/L	NE		J	104141-001	AM20GAX	PACE
6-Dec-17	Ethene	0.18	0.005	0.1	µg/L	NE		J	104088-001	AM20GAX	PACE
11-Dec-17	Ethene	0.17	0.005	0.1	µg/L	NE		J	104168-001	AM20GAX	PACE
19-Dec-17	Ethene	0.26	0.004	0.1	µg/L	NE		J	104176-001	AM20GAX	PACE

Notes

Refer to general footnotes at the end of this appendix.

Specific Notes to Table B-1

Analyte list is specified in DP-1845, Terms and Conditions #17.
cis-1,2 Dichloroethene and vinyl chloride were not detected at well TAV-INJ1.
Trichloroethene was not detected in the samples collected on November 28, 29, and December 1, 2017.
Trichloroethene was not detected in the sample collected on December 19, 2017. However, the sample was analyzed past 1X the analytical method specified holding time but within 2X the specified holding time, due to the holiday season.

Table B-2
Analytical Results of Baseline Sampling at Wells TAV-INJ1, TAV-MW6, and TAV-MW7

Analyses	Analyte ^a	Result ^b	MDL ^c	PQL ^d	Units	Lab Qualifier ^f	Validation Qualifer ^g	Sample No.	Analytical Method ^h	Lab ⁱ
TAV-INJ1 (13-Nov-17)										
Alkalinity	Alkalinity as CaCO3	188	1.45	4	mg/L			103993-009	SM 2320B	GEL
Alkalinity	Alkalinity, bicarb as CaCO3	188	1.45	4	mg/L			103993-009	SM 2320B	GEL
Alkalinity	Alkalinity, carb as CaCO3	ND	1.45	4	mg/L	U		103993-009	SM 2320B	GEL
Ammonia	Ammonia	0.076	0.017	0.05	mg/L		J-	103993-002	EPA 350.1	GEL
Anions	Bromide	1.3	0.067	0.2	mg/L			103993-008	SW846 9056	GEL
Anions	Chloride	114	1.34	4	mg/L			103993-008	SW846 9056	GEL
Anions	Fluoride	0.964	0.033	0.1	mg/L			103993-008	SW846 9056	GEL
Anions	Nitrite	0.126	0.033	0.1	mg/L			103993-006	SW846 9056	GEL
Anions	Orthophosphate as P	ND	0.067	0.2	mg/L	U		103993-003	SW846 9056	GEL
Anions	Sulfate	31.9	2.66	8	mg/L			103993-008	SW846 9056	GEL
Dissolved Metals	Arsenic	ND	0.002	0.005	mg/L	U		103993-010	SW846 3005/6020	GEL
Dissolved Metals	Calcium	67.8	0.8	2	mg/L			103993-010	SW846 3005/6020	GEL
Dissolved Metals	Iron	ND	0.033	0.1	mg/L	U		103993-010	SW846 3005/6020	GEL
Dissolved Metals	Magnesium	20.2	0.01	0.03	mg/L			103993-010	SW846 3005/6020	GEL
Dissolved Metals	Manganese	0.0931	0.001	0.005	mg/L			103993-010	SW846 3005/6020	GEL
Dissolved Metals	Potassium	3.77	0.08	0.3	mg/L			103993-010	SW846 3005/6020	GEL
Dissolved Metals	Sodium	61.5	0.8	2.5	mg/L			103993-010	SW846 3005/6020	GEL
MEE	Methane	ND	0.016	0.5	µg/L	U	UJ	103996-001	AM20GAX	PACE
MEE	Ethane	ND	0.003	0.1	µg/L	U	UJ	103996-001	AM20GAX	PACE
MEE	Ethene	0.21	0.004	0.1	µg/L		J	103996-001	AM20GAX	PACE
Microbial	Dehalococcoides	ND	900	900	Enumeration/L	U		104002-001	Gene-Trac Dhc	SiREM
Nitrate/Nitrite	Nitrate plus nitrite as N	6.48	0.17	0.5	mg/L			103993-007	EPA 353.2	GEL
Sulfide	Sulfide, Reactive	ND	500	500	mg/L	<	R	103993-005	SW846 Chpt. 7.3.4-TI	GEL
TOC	Total Organic Carbon #1	0.579	0.33	1	mg/L	J		103993-004	SW846 9060A	GEL
TOC	Total Organic Carbon #2	0.658	0.33	1	mg/L	J		103993-004	SW846 9060A	GEL
TOC	Total Organic Carbon #3	0.683	0.33	1	mg/L	J		103993-004	SW846 9060A	GEL
TOC	Total Organic Carbon #4	0.688	0.33	1	mg/L	J		103993-004	SW846 9060A	GEL
TOC	Total Organic Carbon Average	0.652	0.33	1	mg/L	J		103993-004	SW846 9060A	GEL
VOC	Dichloroethene, cis-1,2-	0.87	0.3	1	µg/L	J		103993-001	SW846 8260B	GEL
VOC	Trichloroethene	8.33	0.3	1	µg/L			103993-001	SW846 8260B	GEL
TAV-MW6 (14-Nov-17)										
Alkalinity	Alkalinity as CaCO3	195	1.45	4	mg/L			103988-007	SM 2320B	GEL
Alkalinity	Alkalinity, bicarb as CaCO3	195	1.45	4	mg/L			103988-007	SM 2320B	GEL
Alkalinity	Alkalinity, carb as CaCO3	ND	1.45	4	mg/L	U		103988-007	SM 2320B	GEL
Ammonia	Ammonia	0.0462	0.017	0.05	mg/L	JB	0.050UJ	103988-001	EPA 350.1	GEL
Anions	Bromide	0.799	0.067	0.2	mg/L			103988-006	SW846 9056	GEL
Anions	Chloride	75.1	0.67	2	mg/L			103988-006	SW846 9056	GEL
Anions	Fluoride	1.16	0.033	0.1	mg/L			103988-006	SW846 9056	GEL
Anions	Nitrite	ND	0.033	0.1	mg/L	U		103988-005	SW846 9056	GEL
Anions	Orthophosphate as P	ND	0.067	0.2	mg/L	U		103988-002	SW846 9056	GEL
Anions	Sulfate	43.5	1.33	4	mg/L			103988-006	SW846 9056	GEL
Dissolved Metals	Arsenic	ND	0.002	0.005	mg/L	U		103988-008	SW846 3005/6020	GEL
Dissolved Metals	Calcium	64.4	0.4	1	mg/L			103988-008	SW846 3005/6020	GEL
Dissolved Metals	Iron	0.0902	0.033	0.1	mg/L	J		103988-008	SW846 3005/6020	GEL
Dissolved Metals	Magnesium	18.5	0.01	0.03	mg/L			103988-008	SW846 3005/6020	GEL
Dissolved Metals	Manganese	ND	0.001	0.005	mg/L	U		103988-008	SW846 3005/6020	GEL
Dissolved Metals	Potassium	3.66	0.08	0.3	mg/L			103988-008	SW846 3005/6020	GEL
Dissolved Metals	Sodium	61	0.4	1.25	mg/L			103988-008	SW846 3005/6020	GEL
Microbial	Dehalococcoides	ND	1000	1000	Enumeration/L	U		103998-001	Gene-Trac Dhc	SiREM
Nitrate/Nitrite	Nitrate plus nitrite as N	8.15	0.425	1.25	mg/L			103946-002	EPA 353.2	GEL
Sulfide	Sulfide, Reactive	ND	500	500	mg/L	<	R	103988-004	SW846 Chpt. 7.3.4-TI	GEL

Table B-2 (Continued)
Baseline TAV-INJ1, TAV-MW6, TAV-MW7

Analyses	Analyte ^a	Result ^b	MDL ^c	PQL ^d	Units	Lab Qualifier ^f	Validation Qualifer ^g	Sample No.	Analytical Method ^h	Lab ⁱ
TAV-MW6 (14-Nov-17) (Continued)										
TOC	Total Organic Carbon #1	0.452	0.33	1	mg/L	J		103988-003	SW846 9060A	GEL
TOC	Total Organic Carbon #2	0.471	0.33	1	mg/L	J		103988-003	SW846 9060A	GEL
TOC	Total Organic Carbon #3	0.493	0.33	1	mg/L	J		103988-003	SW846 9060A	GEL
TOC	Total Organic Carbon #4	0.481	0.33	1	mg/L	J		103988-003	SW846 9060A	GEL
TOC	Total Organic Carbon Average	0.474	0.33	1	mg/L	J		103988-003	SW846 9060A	GEL
VOC	Dichloroethene, cis-1,2-	1.19	0.3	1	µg/L			103946-001	SW846 8260B	GEL
VOC	Trichloroethene	9.34	0.3	1	µg/L			103946-001	SW846 8260B	GEL
TAV-MW6 (7-Jun-17)										
MEE	Methane	ND	0.027	0.5	µg/L	U	UJ	102724-002	AM20GAX	PACE
MEE	Ethane	ND	0.003	0.1	µg/L	U	UJ	102724-002	AM20GAX	PACE
MEE	Ethene	ND	0.001	0.1	µg/L	U	UJ	102724-002	AM20GAX	PACE
TAV-MW7 (7-Nov-17)										
Alkalinity	Alkalinity as CaCO3	230	1.45	4	mg/L			103990-007	SM 2320B	GEL
Alkalinity	Alkalinity, bicarb as CaCO3	230	1.45	4	mg/L			103990-007	SM 2320B	GEL
Alkalinity	Alkalinity, carb as CaCO3	ND	1.45	4	mg/L	U		103990-007	SM 2320B	GEL
Ammonia	Ammonia	0.107	0.017	0.05	mg/L		J+	103990-001	EPA 350.1	GEL
Anions	Bromide	0.231	0.067	0.2	mg/L			103990-006	SW846 9056	GEL
Anions	Chloride	26.1	0.67	2	mg/L			103990-006	SW846 9056	GEL
Anions	Fluoride	1.1	0.033	0.1	mg/L			103990-006	SW846 9056	GEL
Anions	Nitrite	0.0363	0.033	0.1	mg/L	J		103990-005	SW846 9056	GEL
Anions	Orthophosphate as P	ND	0.067	0.2	mg/L	U		103990-002	SW846 9056	GEL
Anions	Sulfate	59.6	1.33	4	mg/L			103990-006	SW846 9056	GEL
Dissolved Metals	Arsenic	0.00202	0.002	0.005	mg/L	J		103990-008	SW846 3005/6020	GEL
Dissolved Metals	Calcium	58.8	0.8	2	mg/L			103990-008	SW846 3005/6020	GEL
Dissolved Metals	Iron	ND	0.033	0.1	mg/L	U		103990-008	SW846 3005/6020	GEL
Dissolved Metals	Magnesium	19.5	0.01	0.03	mg/L			103990-008	SW846 3005/6020	GEL
Dissolved Metals	Manganese	ND	0.001	0.005	mg/L	U		103990-008	SW846 3005/6020	GEL
Dissolved Metals	Potassium	4.23	0.08	0.3	mg/L			103990-008	SW846 3005/6020	GEL
Dissolved Metals	Sodium	57.6	0.8	2.5	mg/L			103990-008	SW846 3005/6020	GEL
microbial	Dehalococcoides	ND	3000	3000	Enumeration/L	U		104000-001	Gene-Trac DhC	SiREM
Nitrate/Nitrite	Nitrate plus nitrite as N	4.64	0.17	0.5	mg/L			103948-002	EPA 353.2	GEL
Sulfide	Sulfide, Reactive	ND	500	500	mg/L	<	UJ	103990-004	SW846 Chpt. 7.3.4-TI	GEL
TOC	Total Organic Carbon #1	0.476	0.33	1	mg/L	J		103990-003	SW846 9060A	GEL
TOC	Total Organic Carbon #2	0.572	0.33	1	mg/L	J		103990-003	SW846 9060A	GEL
TOC	Total Organic Carbon #3	0.586	0.33	1	mg/L	J		103990-003	SW846 9060A	GEL
TOC	Total Organic Carbon #4	0.579	0.33	1	mg/L	J		103990-003	SW846 9060A	GEL
TOC	Total Organic Carbon Average	0.553	0.33	1	mg/L	J		103990-003	SW846 9060A	GEL
TAV-MW7 (Duplicate) (7-Nov-17)										
Alkalinity	Alkalinity as CaCO3	228	1.45	4	mg/L			103991-007	SM 2320B	GEL
Alkalinity	Alkalinity, bicarb as CaCO3	228	1.45	4	mg/L			103991-007	SM 2320B	GEL
Alkalinity	Alkalinity, carb as CaCO3	ND	1.45	4	mg/L	U		103991-007	SM 2320B	GEL
Ammonia	Ammonia	0.0248	0.017	0.05	mg/L	J	0.05U	103991-001	EPA 350.1	GEL
Anions	Bromide	0.235	0.067	0.2	mg/L			103991-006	SW846 9056	GEL
Anions	Chloride	26.3	0.67	2	mg/L			103991-006	SW846 9056	GEL
Anions	Fluoride	1.1	0.033	0.1	mg/L			103991-006	SW846 9056	GEL
Anions	Nitrite	0.0358	0.033	0.1	mg/L	J		103991-005	SW846 9056	GEL
Anions	Orthophosphate as P	ND	0.067	0.2	mg/L	U		103991-002	SW846 9056	GEL
Anions	Sulfate	60.3	1.33	4	mg/L			103991-006	SW846 9056	GEL
Dissolved Metals	Arsenic	0.002	0.002	0.005	mg/L	J		103991-008	SW846 3005/6020	GEL
Dissolved Metals	Calcium	57.8	0.8	2	mg/L			103991-008	SW846 3005/6020	GEL
Dissolved Metals	Iron	ND	0.033	0.1	mg/L	U		103991-008	SW846 3005/6020	GEL

Table B-2 (Concluded)
Baseline TAV-INJ1, TAV-MW6, TAV-MW7

Analyses	Analyte ^a	Result ^b	MDL ^c	PQL ^d	Units	Lab Qualifier ^f	Validation Qualifier ^g	Sample No.	Analytical Method ^h	Lab ⁱ
TAV-MW7 (Duplicate) (7-Nov-17) (Continued)										
Dissolved Metals	Magnesium	18.8	0.01	0.03	mg/L			103991-008	SW846 3005/6020	GEL
Dissolved Metals	Manganese	ND	0.001	0.005	mg/L	U		103991-008	SW846 3005/6020	GEL
Dissolved Metals	Potassium	4.18	0.08	0.3	mg/L			103991-008	SW846 3005/6020	GEL
Dissolved Metals	Sodium	56.3	0.8	2.5	mg/L			103991-008	SW846 3005/6020	GEL
Microbial	Dehalococcoides	ND	3000	3000	Enumeration/L	U		104001-001	Gene-Trac Dhc	SiREM
Nitrate/Nitrite	Nitrate plus nitrite as N	4.41	0.17	0.5	mg/L			103949-002	EPA 353.2	GEL
Sulfide	Sulfide, Reactive	ND	500	500	mg/L	<	UJ	103991-004	SW846 Chpt. 7.3.4-TI	GEL
TOC	Total Organic Carbon #1	0.522	0.33	1	mg/L	J		103991-003	SW846 9060A	GEL
TOC	Total Organic Carbon #2	0.63	0.33	1	mg/L	J		103991-003	SW846 9060A	GEL
TOC	Total Organic Carbon #3	0.607	0.33	1	mg/L	J		103991-003	SW846 9060A	GEL
TOC	Total Organic Carbon #4	0.597	0.33	1	mg/L	J		103991-003	SW846 9060A	GEL
TOC	Total Organic Carbon Average	0.589	0.33	1	mg/L	J		103991-003	SW846 9060A	GEL
TAV-MW7 (16-May-17)										
MEE	Methane	0.61	0.027	0.5	µg/L		J	102720-002	AM20GAX	PACE
MEE	Ethane	ND	0.003	0.1	µg/L	U	UJ	102720-002	AM20GAX	PACE
MEE	Ethene	ND	0.001	0.1	µg/L	U	UJ	102720-002	AM20GAX	PACE

Notes

Refer to general footnotes at the end of this appendix.

Specific Notes to Table B-2

Analyte list is specified in DP-1845, Terms and Conditions #16.
Only detected VOCs are presented.

Table B-3
Field Water Quality Measurements^j for Baseline Sampling

Well ID	Sample Date	Temperature (°C)	Specific Conductivity (µmho/cm)	Oxidation-Reduction Potential (mV)	pH	Turbidity (NTU)	Dissolved Oxygen (% Sat)	Dissolved Oxygen (mg/L)
TAV-INJ1	13-Nov-17	21.40	825.2	263.6	7.59	4.04	45.2	3.99
TAV-MW6	7-Jun-17	21.42	698.2	160.4	7.54	5.71	78.1	6.89
TAV-MW6	14-Nov-17	20.87	726.9	282.8	7.42	4.44	75.9	6.82
TAV-MW7	16-May-17	20.47	608.6	119.4	7.55	3.93	1.4	0.13
TAV-MW7	07-Nov-17	20.34	615.8	141.2	7.33	2.30	3.6	0.32

Refer to general footnotes at the end of this appendix.

Table B-4
Analytical Results of Groundwater Monitoring at Wells TAV-MW6 and TAV-MW7

Sample Date	Analyte ^a	Result ^b	MDL ^c	PQL ^d	Units	Groundwater Standard ^e	Lab Qualifier ^f	Validation Qualifier ^g	Sample No.	Analytical Method ^h	Lab ⁱ
TAV-MW6											
5-Dec-17	Trichloroethene	9.3	0.3	1	µg/L	0.1 mg/L			104095-001	SW846 8260B	GEL
13-Dec-17	Trichloroethene	8.93	0.3	1	µg/L	0.1 mg/L			104150-001	SW846 8260B	GEL
13-Dec-17 (Dup)	Trichloroethene	9.33	0.3	1	µg/L	0.1 mg/L			104151-001	SW846 8260B	GEL
5-Dec-17	Nitrite	ND	0.033	0.1	mg/L	NE	U		104095-006	SW846 9056	GEL
13-Dec-17	Nitrite	ND	0.033	0.1	mg/L	NE	U	UJ	104150-006	SW846 9056	GEL
13-Dec-17 (Dup)	Nitrite	ND	0.033	0.1	mg/L	NE	U	UJ	104151-006	SW846 9056	GEL
5-Dec-17	Nitrate plus nitrite as N	9.15	0.425	1.25	mg/L	10.0 mg/L			104095-007	EPA 353.2	GEL
13-Dec-17	Nitrate plus nitrite as N	8.15	0.425	1.25	mg/L	10.0 mg/L		J	104150-007	EPA 353.2	GEL
13-Dec-17 (Dup)	Nitrate plus nitrite as N	8.28	0.425	1.25	mg/L	10.0 mg/L		J	104151-007	EPA 353.2	GEL
5-Dec-17	Arsenic	ND	0.002	0.005	mg/L	0.1 mg/L	U		104095-010	SW846 3005/6020	GEL
13-Dec-17	Arsenic	ND	0.002	0.005	mg/L	0.1 mg/L	U		104150-010	SW846 3005/6020	GEL
13-Dec-17 (Dup)	Arsenic	ND	0.002	0.005	mg/L	0.1 mg/L	U		104151-010	SW846 3005/6020	GEL
5-Dec-17	Iron	0.0914	0.033	0.1	mg/L	1.0 mg/L	J		104095-010	SW846 3005/6020	GEL
13-Dec-17	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		104150-010	SW846 3005/6020	GEL
13-Dec-17 (Dup)	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		104151-010	SW846 3005/6020	GEL
5-Dec-17	Manganese	0.00162	0.001	0.005	mg/L	0.2 mg/L	J		104095-010	SW846 3005/6020	GEL
13-Dec-17	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U	UJ	104150-010	SW846 3005/6020	GEL
13-Dec-17 (Dup)	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U	UJ	104151-010	SW846 3005/6020	GEL
13-Dec-17	Dichloroethene, cis-1,2-	1.31	0.3	1	µg/L	NE			104150-001	SW846 8260B	GEL
5-Dec-17	Dichloroethene, cis-1,2-	1.44	0.3	1	µg/L	NE			104095-001	SW846 8260B	GEL
13-Dec-17 (Dup)	Dichloroethene, cis-1,2-	1.31	0.3	1	µg/L	NE			104151-001	SW846 8260B	GEL
5-Dec-17	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104093-001	AM20GAX	PACE
13-Dec-17	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104162-001	AM20GAX	PACE
13-Dec-17 (Dup)	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104163-001	AM20GAX	PACE
TAV-MW7											
4-Dec-17	Nitrite	ND	0.033	0.1	mg/L	NE	U		104099-006	SW846 9056	GEL
12-Dec-17	Nitrite	ND	0.033	0.1	mg/L	NE	U		104153-006	SW846 9056	GEL
4-Dec-17	Nitrate plus nitrite as N	3.93	0.17	0.5	mg/L	10.0 mg/L			104099-007	EPA 353.2	GEL
12-Dec-17	Nitrate plus nitrite as N	4.09	0.17	0.5	mg/L	10.0 mg/L		J	104153-007	EPA 353.2	GEL
4-Dec-17	Arsenic	ND	0.002	0.005	mg/L	0.1 mg/L	U		104099-010	SW846 3005/6020	GEL
12-Dec-17	Arsenic	0.00206	0.002	0.005	mg/L	0.1 mg/L	J		104153-010	SW846 3005/6020	GEL
4-Dec-17	Iron	0.0854	0.033	0.1	mg/L	1.0 mg/L	J		104099-010	SW846 3005/6020	GEL
12-Dec-17	Iron	ND	0.033	0.1	mg/L	1.0 mg/L	U		104153-010	SW846 3005/6020	GEL
4-Dec-17	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U		104099-010	SW846 3005/6020	GEL
12-Dec-17	Manganese	ND	0.001	0.005	mg/L	0.2 mg/L	U	UJ	104153-010	SW846 3005/6020	GEL
4-Dec-17	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104091-001	AM20GAX	PACE
12-Dec-17	Ethene	ND	0.005	0.1	µg/L	NE	U	UJ	104165-001	AM20GAX	PACE

Notes

Refer to general footnotes at the end of this appendix.

Specific Notes to Table B-4

Analyte list is specified in DP-1845, Terms and Conditions #17.
Vinyl chloride was not detected at well TAV-MW6.
cis-1,2 Dichloroethene, trichloroethene, and vinyl chloride were not detected at well TAV-MW7.

Footnotes for Appendix B Analytical Results Tables

%	= Percent.
CaCO ₃	= Calcium carbonate.
DP	= Discharge Permit.
Dup	= Duplicate.
EPA	= U.S. Environmental Protection Agency.
ID	= Identifier.
MEE	= Methane, ethane, and ethene.
µg/L	= Micrograms per liter.
mg/L	= Milligrams per liter.
No.	= Number.
TOC	= Total organic carbon.
VOC	= Volatile organic compounds.

^aAnalyte

The analyte list is specified in DP-1845 Terms and Conditions. Below are the tables and the Terms and Conditions number:

Table B-1: Terms and Conditions #17 of DP-1845.

Table B-2: Terms and Conditions #16 of DP-1845.

Table B-4: Terms and Conditions #17 of DP-1845.

^bResult

Detected VOCs are presented in the tables.

Bold = Value exceed the established Groundwater Standard.

ND = Not detected (at method detection limit).

^cMDL

MDL = Method detection limit. The minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero, analyte is matrix specific.

^dPQL

PQL = Practical quantitation limit. The lowest concentration of analytes in a sample that can be reliably determined within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions.

^eGroundwater Standard

Groundwater Standards are from 20.6.2.3103 New Mexico Administrative Code (NMAC).

NE = Not established in 20.6.2.3103 NMAC.

Footnotes for Appendix B Analytical Results Tables (Concluded)

^fLab Qualifier

If cell is blank, the all quality control samples met acceptance criteria with respect to submitted samples.

- < = Less than value for flashpoint.
- B = The analyte was found in the blank above the effective MDL.
- H = Analytical holding time was exceeded.
- h = Prep holding time exceeded.
- J = Estimated value, the analyte concentration fell above the effective MDL and below the effective PQL.
- N = Results associated with a spike analysis that was outside control limits.
- NA = Not applicable.
- U = Analyte is absent or below the method detection limit.
- X = Data rejected due to peak not meeting identification criteria.

^gValidation Qualifier

If cell is blank, then all quality control samples met acceptance criteria with respect to submitted samples.

- BD = Below detection limit as used in radiochemistry to identify results that are not statistically different from zero.
- J = The associated value is an estimated quantity.
- J- = Estimated value with a suspected negative bias.
- J+ = Estimated value with a suspected positive bias.
- R = The data are unusable, and resampling or reanalysis are necessary for verification.
- U = The analyte was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
- UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

^hAnalytical Method

Clesceri, Rice, Baird, and Eaton, 2012, *Standard Methods for the Examination of Water and Wastewater*, 22nd ed., Method 2320B, published jointly by American Public Health Association, American Water Works Association, and Water Environment Federation. Washington, D.C.

EPA, 1986, (and updates), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd ed.

EPA, 1984, "Methods for Chemical Analysis of Water and Wastes." EPA 600-4-79-020.

AM20GAX = Proprietary method of Pace Analytical Energy Services LLC.

Gene-Trac Dhc = Proprietary method of SiREM.

ⁱLab

- GEL = GEL Laboratories LLC, 2040 Savage Rd, Charleston, SC 29407.
- PACE = Pace Analytical Energy Services LLC, 220 William Pitt Way, Pittsburgh, PA 15238.
- SiREM = SiREM, 130 Stone Rd. W, Guelph, Ontario, N1G 3Z2, Canada.

^jField Water Quality Measurements

Field measurements collected prior to sampling.

- °C = Degrees Celsius.
- % Sat = Percent saturation.
- µmho/cm = Micromhos per centimeter.
- mg/L = Milligrams per liter.
- mV = Millivolts.
- NTU = Nephelometric turbidity units.
- pH = Potential of hydrogen (negative logarithm of the hydrogen ion concentration).

Attachment A
Ground Water Discharge Permit
Sandia National Laboratories, New Mexico
Discharge Permit DP-1845



SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

**NEW MEXICO
ENVIRONMENT DEPARTMENT**

Ground Water Quality Bureau
1190 South St. Francis Drive (87505)
P.O. Box 5469, Santa Fe, New Mexico 87502-5469
Phone (505) 827-2900 Fax (505) 827-2965
www.env.nm.gov



BUTCH TONGATE
Cabinet Secretary

J.C. BORREGO
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 26, 2017

Mr. James Todd, Assistant Manager for Engineering
U.S. Department of Energy
P.O. Box 5400
Albuquerque, NM 87185

RE: Discharge Permit, DP-1845, Sandia National Laboratories/New Mexico

Dear Mr. Todd:

The New Mexico Environment Department (NMED) issues the enclosed Discharge Permit, DP-1845, to the U. S. Department of Energy/National Nuclear Security Administration, Sandia Field Office (permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Ground and Surface Water Protection Regulations, 20.6.2 NMAC.

The Discharge Permit contains terms and conditions that shall be complied with by the permittee and are enforceable by NMED pursuant to Section 20.6.2.3104 NMAC and NMSA 1978 §74-6-5 and §74-6-10. Please be aware that this Discharge Permit may contain conditions that require the permittee to implement operational, monitoring, or closure actions by a specified deadline.

Issuance of this Discharge Permit does not relieve the permittee of the responsibility to comply with the WQA, the Ground and Surface Water Protection Regulations, and any other applicable federal, state, and/or local laws, regulations, zoning requirements, and nuisance ordinances.

Pursuant to Paragraph (4) of Subsection H of 20.6.2.3109 NMAC, the term of the Discharge Permit shall be five years from the effective date. The term of this Discharge Permit will end on May 26, 2022.

NMED requests that the permittee submit an application for renewal (or renewal and modification) at least 180 days prior to the date the Discharge Permit term ends.

May 26, 2017

Page 2 of 2

An invoice for the Discharge Permit Fee of \$3,450 is being sent under separate cover. Payment of the Discharge Permit Fee must be received by NMED within 30 days of the date the Discharge Permit is issued.

If you have any questions, please contact Kellie Jones at (505) 827-2949. Thank you for your cooperation during this Discharge Permit review.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:kj

Encs: Discharge Permit, DP-1845
Discharge Permit Summary
Ground Water Discharge Permit Monitoring Well Construction and Abandonment
Conditions, Revision 1.1, March 2011

cc: John Rhoderick, District Manager, NMED District I (electronic copy)
John Romero, Office of the State Engineer (electronic copy)

GROUND WATER DISCHARGE PERMIT
Sandia National Laboratories/New Mexico
Discharge Permit-1845

I. INTRODUCTION

The New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) issues this Discharge Permit (DP-1845) for discharges via Class V underground injection control (UIC) wells to the U. S. Department of Energy/National Nuclear Security Administration, Sandia Field Office (permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Water Quality Control Commission (WQCC) Ground and Surface Water Protection Regulations, 20.6.2 NMAC.

NMED's purpose in issuing this Discharge Permit, and in imposing the requirements and conditions specified herein, is to control the discharge of water contaminants from Sandia National Laboratories (SNL)/New Mexico (facility) into ground and surface waters, so as to protect ground and surface waters for present and potential future use as domestic and agricultural water supply and other uses and protect public health. In issuing this Discharge Permit, NMED has determined that the requirements of Subsection C of 20.6.2.3109 NMAC have been or will be met. Pursuant to Section 20.6.2.3104 NMAC, it is the responsibility of the permittee to comply with the terms and conditions of this Discharge Permit; failure to do so may result in an enforcement action(s) by NMED (20.6.2.1220 NMAC).

The activities that produce the discharge, the location of the discharge, and the quantity, quality, and flow characteristics of the discharge are briefly described as follows.

Up to 20,000 gallons per day (gpd) of groundwater will be extracted from TAV-INJ1, TAV-INJ2, and TAV-INJ3, pursuant to regulatory activities being conducted under the SNL Compliance Order on Consent overseen by the NMED Hazardous Waste Bureau in accordance with the New Mexico Hazardous Waste Act and the New Mexico Solid Waste Act. The groundwater is to be extracted from within a contaminant plume affected by trichloroethene (TCE) and nitrate, mixed with substrate solution components and biodegradation bacteria to facilitate bioremediation, and then gravity-fed into three underground injection control wells (TAV-INJ1, TAV-INJ2, and TAV-INJ3) within the contaminant plume. Daily injections will be followed with approximately 100 gallons of chase water, consisting of potable water (without amendments) deoxygenated by sparging with argon gas, to effectively push bioremediation reagents into the groundwater formation.

The discharge contains water contaminants that may be elevated above the standards of Section 20.6.2.3103 NMAC and/or the presence of toxic pollutants as defined in Subsection WW of 20.6.2.7 NMAC and as allowed under 20.6.2.3109.D(1). Data collected from on-site monitoring wells document groundwater contamination attributed to one or more sources at this facility. Groundwater quality standards for TCE and nitrate have been exceeded according to the criteria of Sections 20.6.2.3101 and 20.6.2.3103 NMAC.

The facility is located in Albuquerque on Kirtland Air Force Base, approximately one mile southwest of the intersection of Pennsylvania Avenue and TA-III/V in Section 20, Township 9N,

Range 4E, Bernalillo County. Groundwater most likely to be affected is at a depth of approximately 500 feet and has a total dissolved solids concentration (TDS) of approximately 423 milligrams per liter (mg/L).

The application (i.e., discharge plan) consists of the materials submitted by the permittee dated July 25, 2016 and materials contained in the administrative record prior to issuance of this Discharge Permit. The discharge shall be managed in accordance with all conditions and requirements of this Discharge Permit.

Pursuant to Section 20.6.2.3109 NMAC, NMED reserves the right to require a Discharge Permit Modification in the event NMED determines that the requirements of 20.6.2 NMAC are being or may be violated or the standards of Section 20.6.2.3103 NMAC are being or may be violated. This may include a determination that structural controls and/or management practices approved under this Discharge Permit are not protective of groundwater quality, and that more stringent requirements to protect groundwater quality may be required by NMED. The permittee may be required to implement abatement of water pollution and remediate groundwater quality.

Issuance of this Discharge Permit does not relieve the permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state, and/or local laws, regulations, zoning requirements, and nuisance ordinances.

The following acronyms and abbreviations may be used in this Discharge Permit:

Abbreviation	Explanation	Abbreviation	Explanation
EPA	U.S. Environmental Protection Agency	TCE	Trichloroethene
gpd	gallons per day	TDS	total dissolved solids
mg/L	milligrams per liter	UIC	Underground Injection Control
NMAC	New Mexico Administrative Code	WQA	New Mexico Water Quality Act
NMED	New Mexico Environment Department	WQCC	Water Quality Control Commission
NMSA	New Mexico Statutes Annotated		

II. FINDINGS

In issuing this Discharge Permit, NMED finds the following:

1. The permittee is discharging effluent or leachate from the facility so that such effluent or leachate may move directly or indirectly into groundwater within the meaning of Section 20.6.2.3104 NMAC.
2. The permittee is discharging effluent or leachate from the facility so that such effluent or leachate may move into groundwater of the State of New Mexico that has an existing

concentration of 10,000 mg/L or less of TDS within the meaning of Subsection A of 20.6.2.3101 NMAC.

3. The discharge from the facility is not subject to any of the exemptions of Section 20.6.2.3105 NMAC.
4. The permittee proposes to operate Class V UIC wells within the meaning of 20.6.2.5002.A(1) and 20.6.2.5002.B(5)(d)(i) NMAC which are subject to the prohibitions listed under 20.6.2.5004.A(4) NMAC.

III. AUTHORIZATION TO DISCHARGE

Pursuant to 20.6.2.3104 NMAC, it is the responsibility of the permittee to ensure that discharges authorized by this Discharge Permit are consistent with the terms and conditions herein.

The permittee is authorized to discharge up to 20,000 gpd of potable water and/or groundwater being extracted pursuant to regulatory activities being conducted under the SNL Compliance Order on Consent overseen by the NMED Hazardous Waste Bureau in accordance with the New Mexico Hazardous Waste Act and the New Mexico Solid Waste Act. The groundwater is to be extracted from within a contaminant plume affected by TCE and nitrate, and will be utilized to enhance biologically mediated degradation of the contaminant plume. These contaminants at their measured concentrations may be reinjected into the regional aquifer pursuant to Subsection D(1) of 20.6.2.3109 NMAC. Three UIC wells will be installed via air-rotary, casing-hammer method. The wells to be installed are TAV-INJ1, TAV-INJ2, and TAV-INJ3. Potable water or groundwater being extracted will be mixed with substrate solution components consisting of nutrients, inert tracer elements which will be used as a performance monitoring measure, and microbiologic cultures, collectively referred to as effluent, then gravity-fed into the UIC wells to facilitate in situ bioremediation. Each daily injection will be followed with approximately 100 gallons of chase water consisting of potable water (without amendments) deoxygenated by sparging with argon gas.

[20.6.2.3104 NMAC, Subsection C of 20.6.2.3106 NMAC, Subsection C of 20.6.2.3109 NMAC]

IV. CONDITIONS

The following conditions shall be complied with by the permittee and are enforceable by NMED. NMED issues this Discharge Permit for the discharge of water contaminants subject to the following conditions.

A. OPERATIONAL PLAN

#	Terms and Conditions
1.	The permittee shall implement the following operational plan to ensure compliance with Title 20, Chapter 6, Parts 2 and 4 NMAC.

#	Terms and Conditions
	[Subsection C of 20.6.2.3109 NMAC]
2.	<p>The permittee shall operate in a manner such that standards and requirements of Sections 20.6.2.3101 and 20.6.2.3103 NMAC are not violated.</p> <p>[20.6.2.3101 NMAC, 20.6.2.3103 NMAC, Subsection C of 20.6.2.3109 NMAC]</p>

Operating Conditions

#	Terms and Conditions
3.	<p>Prior to commencing injection activities, the permittee shall demonstrate the mechanical integrity of the aboveground distribution piping and injection well heads associated with this Discharge Permit. Prior to testing, the permittee shall propose for NMED approval the test method to be used. The results of the mechanical integrity testing shall be submitted to NMED within 30 days of test completion and prior to injection.</p> <p>The permittee shall demonstrate mechanical integrity of the aboveground distribution piping and injection well heads associated with this Discharge Permit at least once every five years. If the distribution piping or an injection well head is reconfigured, the permittee must conduct a mechanical integrity test prior to re-injection of effluent into the subsurface at that well.</p> <p>[Subsection C of 20.6.2.3106 NMAC, Subsection A of 20.6.2.3107 NMAC, Subsection B of 20.6.2.5204 NMAC]</p>
4.	<p>The permittee is authorized to install and operate not more than three Class V UIC wells. Initial discharge (Phase 1) shall be to TAV-INJ 1 for a pilot test followed by a full scale implementation of the treatment system. Phase 2 is proposed to include the addition of UIC wells TAV-INJ 2 and TAV-INJ 3 for full scale implementation of the treatment system.</p> <p>[20.6.2.3109.C NMAC, 20.7.10.100 NMAC]</p>
5.	<p>Prior to the first discharge from the system to any of the injection wells, the permittee shall submit written notification to NMED stating the date that the discharge is to commence.</p> <p>[20.6.2.3107.A NMAC]</p>
6.	<p>The permittee shall ensure that the injection treatment facility is secured to control access by the general public.</p> <p>[20.6.2.3109.B-C NMAC, NMSA 1978, §74-6-5.]</p>

#	Terms and Conditions
7.	The permittee shall maintain signs in English and Spanish (unless otherwise prohibited by policy) at appropriate locations indicating that the effluent may not be potable. Signs shall be posted at the UIC wellheads, at any associated storage vessels, and at any other area where there is potential for persons to contact associated materials or equipment. [20.6.2.3109 NMAC.B-C, NMSA 1978, § 74-6-5.D]
8.	The permittee shall ensure that the Class V UIC wells include monitoring devices, i.e., water level and pressure head transducers, to prevent overfilling of the well. [20.6.2.3107, 20.6.2.3109.C(3)(c)(i)]

B. MONITORING AND REPORTING

#	Terms and Conditions
9.	The permittee shall conduct the monitoring, reporting, and other requirements listed below in accordance with the monitoring requirements of this Discharge Permit. [Subsection A of 20.6.2.3107 NMAC, Subsection C of 20.6.2.3109 NMAC]
10.	METHODOLOGY - Unless otherwise approved in writing by NMED, the permittee shall conduct sampling and analysis in accordance with the most recent edition of the following documents. a) American Public Health Association, <i>Standard Methods for the Examination of Water and Wastewater</i> (18th, 19th or current); b) U.S. Environmental Protection Agency, <i>Methods for Chemical Analysis of Water and Waste</i> ; c) U.S. Geological Survey, <i>Techniques for Water Resource Investigations of the U.S. Geological Survey</i> ; d) American Society for Testing and Materials, <i>Annual Book of ASTM Standards, Part 31. Water</i> ; e) U.S. Geological Survey, et al., <i>National Handbook of Recommended Methods for Water Data Acquisition</i> ; f) Federal Register, latest methods published for monitoring pursuant to Resource Conservation and Recovery Act regulations; and a) American Society of Agronomy, <i>Chemical Methods: Methods of Soil Analysis; Part 1. Physical and Mineralogical Methods; Part 2. Microbiological and Biochemical Properties; Part 3.</i> [Subsection B of 20.6.2.3107 NMAC]
11.	The permittee shall submit quarterly monitoring reports to NMED for the most recently completed quarterly period by the 1st of February, May, August, and November each year.

#	Terms and Conditions
	<p>The quarterly reports shall document the influent and discharge volumes from the treatment systems, quarterly groundwater and effluent sampling results, and any operations/maintenance activities performed for the prior quarter.</p> <p>Quarterly monitoring shall be performed during the following periods and submitted as follows.</p> <ul style="list-style-type: none"> • January 1st through March 31st (first quarter) – due by August 1st; • April 1st through June 30th (second quarter) – due by November 1st; • July 1st through September 30th (third quarter) – due by February 1st; and • October 1st through December 31st (fourth quarter) – due by May 1st. <p>[Subsection A of 20.6.2.3107 NMAC]</p>
12.	<p>Quarterly reports shall include the following general information:</p> <ol style="list-style-type: none"> a) any periodic test of mechanical integrity conducted; b) any replacement of primary or secondary vessels or associated treatment system infrastructure with an accompanying narrative explanation of the reasons for the decision to replace the vessels; c) any well work-overs conducted; and d) any additional operational changes with the potential to markedly affect the discharge. <p>[20.6.2.3107 NMAC]</p>
13.	<p>Quarterly reports shall include the following system performance information:</p> <ol style="list-style-type: none"> a) monthly average, maximum, and minimum values for flow rate and volume of effluent transferred to each injection well; b) the totalized monthly volume of effluent transferred to each injection well; c) monthly average, maximum, and minimum values of injection water level (pressure head) above static level for each injection well; and d) the volume pumped from each extraction well. <p>Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations.</p> <p>[20.6.2.3107 NMAC]</p>
14.	<p>The permittee shall develop a groundwater elevation contour map on a quarterly basis using the top of casing elevation data and quarterly depth-to-most-shallow groundwater measurements obtained from the groundwater monitoring wells required by this Discharge Permit.</p> <p>The groundwater elevation contour map shall depict the groundwater flow direction based on the groundwater elevation contours. Groundwater elevations between monitoring well</p>

#	Terms and Conditions
	<p>locations shall be estimated using common interpolation methods. A contour interval appropriate to the data shall be used, but in no case shall the interval be greater than two feet. Groundwater elevation contour maps shall depict the groundwater flow direction, using arrows, based on the orientation of the groundwater elevation contours, and the location and identification of each monitoring well and contaminant source. The groundwater elevation contour map shall be submitted to NMED in the quarterly monitoring reports.</p> <p>[20.6.2.3107 NMAC]</p>
15.	<p>NMED shall have the option to perform downhole inspections of all monitoring and UIC wells identified in this Discharge Permit. NMED shall establish the inspection date and provide at least a 60-day notice to the permittee by certified mail. The permittee shall have any existing dedicated pumps removed at least 48 hours prior to NMED inspection to allow adequate settling time of sediment agitated from pump removal.</p> <p>Should a facility not have existing dedicated pumps, but decide to install pumps in any of the monitoring wells, NMED shall be notified at least 90 days prior to pump installation so that a downhole well inspection(s) can be scheduled prior to pump placement.</p> <p>All confirmation analysis will be conducted by an independent environmental laboratory that is certified under the National Environmental Laboratory Accreditation Program (NELAP).</p> <p>[Subsections A and D of 20.6.2.3107 NMAC]</p>

Facility Monitoring Conditions

#	Terms and Conditions
16.	<p>Groundwater samples shall be collected from each new injection well and associated monitoring well prior to discharge, and analyzed for the constituents listed below to establish baseline conditions prior to substrate injection.</p> <ul style="list-style-type: none"> • Alkalinity (total, bicarbonate and carbonate) • Ammonia (as nitrogen) • Anions (bromide, chloride, fluoride, nitrite and sulfate) • Dehalococcoides • Dissolved metals (arsenic, calcium, iron, magnesium, manganese, potassium, sodium) • Methane/ethane • Nitrate as nitrogen • Nitrite as nitrogen

#	Terms and Conditions
	<ul style="list-style-type: none">• Nitrate plus nitrite (as nitrogen)• Orthophosphate (as phosphorus)• Total organic carbon• Sulfide• Volatile organic compounds <p>Field parameters pH, specific conductivity, temperature, turbidity, dissolved oxygen, and oxidation reduction potential shall also be collected.</p> <p>[20.6.2.3107 NMAC]</p>
17.	<p>The permittee shall monitor the groundwater wells TAV-MW6, TAV-MW7, TAV-MW-10, and LWDS-MW-1 quarterly to determine any change to aquifer chemistry and aquifer flow direction that may be the result of injection.</p> <p>This quarterly monitoring shall include analysis for the following analytes:</p> <ul style="list-style-type: none">• TCE• Nitrate as nitrogen• Nitrite as nitrogen• Nitrate plus nitrite (as nitrogen)• Arsenic• Iron• Manganese• cis-1,2-DCE• Vinyl chloride• Ethene <p>Annual sampling will include general chemistry, radiological screening parameters, and total metals as proposed by the permittee to supplement waste characterization requirements and as required under the SNL Compliance Order on Consent.</p> <p>If the chemical quality of the groundwater being injected changes over time, NMED may require the permittee to conduct geochemical modeling to predict the interaction between the injection fluid and receiving groundwater. Results of all geochemical modeling shall be provided to NMED and shall include predictions on any changes to aquifer porosity and hydraulic conductivity that may result from mineral precipitation or dissolution.</p> <p>[20.6.2.3107 NMAC]</p>

C. CONTINGENCY PLAN

#	Terms and Conditions
18.	<p>In the event that groundwater monitoring indicates that a groundwater quality standard identified in Section 20.6.2.3103 NMAC is exceeded, or a toxic pollutant (defined in Subsection WW of 20.6.2.7 NMAC) is present in a groundwater sample and in any subsequent groundwater sample collected from a monitoring well required by this Discharge Permit that is attributable to this discharge, the permittee shall enact the following contingency plan.</p> <p>Within 60 days of the receipt of subsequent sample analysis results, the permittee shall propose measures to ensure that the exceedance of the standard or the presence of a toxic pollutant will be mitigated by submitting a corrective action plan to NMED for approval. The corrective action plan shall include a description of the proposed actions to control the source and an associated completion schedule. The plan shall be enacted as approved by NMED.</p> <p>Once invoked (whether during the term of this Discharge Permit, or after the term of this Discharge Permit and prior to the completion of the Discharge Permit closure plan requirements), this condition shall apply until the permittee has fulfilled the requirements of this condition and groundwater monitoring confirms for a minimum of two years of consecutive groundwater sampling events that the standards of Section 20.6.2.3103 NMAC are not exceeded and toxic pollutants are not present in groundwater.</p> <p>The permittee may be required to abate water pollution pursuant to Sections 20.6.2.4000 through 20.6.2.4115 NMAC, should the corrective action plan not result in compliance with the standards and requirements set forth in Section 20.6.2.4103 NMAC within 180 days of confirmed groundwater contamination.</p> <p>[Subsection A of 20.6.2.3107 NMAC, Subsection E of 20.6.2.3109 NMAC]</p>
19.	<p>In the event that a release ("spill") occurs that is not authorized under this Discharge Permit, the permittee shall take measures to mitigate damage from the unauthorized discharge and initiate the notifications and corrective actions required in Section 20.6.2.1203 NMAC and summarized below.</p> <p>Within 24 hours following discovery of the unauthorized discharge, the permittee shall verbally notify NMED and provide the following information.</p> <ol style="list-style-type: none"> The name, address, and telephone number of the person or persons in charge of the facility, as well as of the owner and/or operator of the facility. The name and address of the facility. The date, time, location, and duration of the unauthorized discharge. The source and cause of unauthorized discharge. A description of the unauthorized discharge, including its estimated chemical composition.

#	Terms and Conditions
	<p>f) The estimated volume of the unauthorized discharge.</p> <p>g) Any actions taken to mitigate immediate damage from the unauthorized discharge.</p> <p>Within one week following discovery of the unauthorized discharge, the permittee shall submit written notification to NMED with the information listed above and any pertinent updates.</p> <p>Within 15 days following discovery of the unauthorized discharge, the permittee shall submit a corrective action report/plan to NMED describing any corrective actions taken and/or to be taken relative to the unauthorized discharge that includes the following information.</p> <p>a) A description of proposed actions to mitigate damage from the unauthorized discharge.</p> <p>b) A description of proposed actions to prevent future unauthorized discharges of this nature.</p> <p>c) A schedule for completion of proposed actions.</p> <p>In the event that the unauthorized discharge causes or may with reasonable probability cause water pollution in excess of the standards and requirements of Section 20.6.2.4103 NMAC, and the water pollution will not be abated within 180 days after notice is required to be given pursuant to Paragraph (1) of Subsection A of 20.6.2.1203 NMAC, the permittee may be required to abate water pollution pursuant to Sections 20.6.2.4000 through 20.6.2.4115 NMAC.</p> <p>Nothing in this condition shall be construed as relieving the permittee of the obligation to comply with all requirements of Section 20.6.2.1203 NMAC.</p> <p>[20.6.2.1203 NMAC]</p>
20.	<p>In the event that NMED or the permittee identifies any failures of the discharge plan or this Discharge Permit not specifically noted herein, NMED may require the permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failure(s). Additionally, NMED may require a Discharge Permit modification to achieve compliance with 20.6.2 NMAC.</p> <p>[Subsection A of 20.6.2.3107 NMAC, Subsection E of 20.6.2.3109 NMAC]</p>

D. CLOSURE PLAN

#	Terms and Conditions
21.	<p>Upon cessation of the activity pursuant to the discharge permit, the permittee shall perform the following closure measures for this Discharge Permit:</p> <p>a) Cap, plug, or remove all lines to prevent the discharge to all UIC wells;</p> <p>b) Abandon UIC wells in accordance with State of New Mexico Oil Conservation Division guidelines as described in the <i>Oil Conservation Division Underground</i></p>

	<p><i>Injection Control Program Manual</i>, February 26, 2004 and/or change well classification;</p> <p>c) Appropriately dispose of liquids, solids, and treatment media; and</p> <p>d) Submit a request to NMED to terminate this Discharge Permit.</p> <p>Upon cessation of the closure measures, the permittee shall perform the following post-closure measures:</p> <p>e) Continue groundwater monitoring for at least two years, or as appropriate and in concurrence with NMED;</p> <p>f) Enact contingency plans if groundwater standards are exceeded, including any abatement required by NMED pursuant to actions related to this discharge permit; and</p> <p>g) Following notification from NMED that post-closure monitoring may cease, the permittee shall plug and abandon the monitoring well(s) in accordance with the attachment titled <i>Ground Water Discharge Permit Monitoring Well Construction and Abandonment Conditions</i>, Revision 1.1. March 2011.</p> <p>When all post-closure requirements have been met, the permittee may request to terminate the discharge permit.</p> <p>[20.6.2.3107 (A)11 NMAC]</p>
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E. GENERAL TERMS AND CONDITIONS

#	Terms and Conditions
22.	<p>RECORD KEEPING - The permittee shall maintain a written record of:</p> <ul style="list-style-type: none"> • information and data used to complete the application for this Discharge Permit; • any releases ("spills") not authorized under this Discharge Permit and reports submitted pursuant to 20.6.2.1203 NMAC; • the operation, maintenance, and repair of all facilities/equipment used to treat, store, or dispose of wastewater; • facility record drawings (plans and specifications) showing the actual construction of the facility and bearing the seal and signature of a licensed New Mexico professional engineer; • copies of monitoring reports completed and/or submitted to NMED pursuant to this Discharge Permit; • the volume of wastewater or other wastes discharged pursuant to this Discharge Permit; • groundwater quality and wastewater quality data collected pursuant to this Discharge Permit; • copies of construction records (well logs) for all groundwater monitoring wells required to be sampled pursuant to this Discharge Permit; • the maintenance, repair, replacement or calibration of any monitoring equipment or flow measurement devices required by this Discharge Permit; and

#	Terms and Conditions
	<ul style="list-style-type: none"> • data and information related to field measurements, sampling, and analysis conducted pursuant to this Discharge Permit, including: <ul style="list-style-type: none"> ○ the dates, location, and times of sampling or field measurements; ○ the name and job title of the individuals who performed each sample collection or field measurement; ○ the sample analysis date of each sample; ○ the name and address of the laboratory, and the name of the signatory authority for the laboratory analysis; ○ the analytical technique or method used to analyze each sample or collect each field measurement; ○ the results of each analysis or field measurement, including raw data; ○ the results of any split, spiked, duplicate or repeat sample; and ○ a copy of the laboratory analysis chain-of-custody as well as a description of the quality assurance and quality control procedures used. <p>The written record shall be maintained by the permittee at a location accessible during a facility inspection by NMED for a period of at least five years from the date of application, report, collection, or measurement and shall be made available to the department upon request.</p> <p>[Subsections A and D of 20.6.2.3107 NMAC]</p>
23.	<p>INSPECTION and ENTRY - The permittee shall allow inspection by NMED of the facility and its operations that are subject to this Discharge Permit and the WQCC regulations. NMED may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which are located any records required to be maintained by regulations of the federal government or the WQCC.</p> <p>The permittee shall allow NMED to have access to and reproduce for their use any copy of the records, and to perform assessments, sampling, or monitoring during an inspection for the purpose of evaluating compliance with this Discharge Permit and the WQCC regulations.</p> <p>Nothing in this Discharge Permit shall be construed as limiting in any way the inspection and entry authority of NMED under the WQA, the WQCC Regulations, or any other local, state, or federal regulations.</p> <p>[Subsection D of 20.6.2.3107 NMAC, NMSA 1978, §§ 74-6-9.B and 74-6-9.E]</p>
24.	<p>DUTY to PROVIDE INFORMATION - The permittee shall, upon NMED's request, allow for NMED's inspection/duplication of records required by this Discharge Permit and/or furnish to NMED copies of such records.</p>

#	Terms and Conditions
	[Subsection D of 20.6.2.3107 NMAC]
25.	<p>MODIFICATIONS and/or AMENDMENTS - In the event the permittee proposes a change to the facility or the facility's discharge that would result in a change in the volume discharged; the location of the discharge; or in the amount or character of water contaminants received, treated, or discharged by the facility, the permittee shall notify NMED prior to implementing such changes. The permittee shall obtain approval (which may require modification of this Discharge Permit) by NMED prior to implementing such changes.</p> <p>[Subsection C of 20.6.2.3107 NMAC, Subsections E and G of 20.6.2.3109 NMAC]</p>
26.	<p>PLANS and SPECIFICATIONS - In the event the permittee is proposing to construct a wastewater system or change a process unit of an existing system such that the quantity or quality of the discharge will change substantially from that authorized by this Discharge Permit, the permittee shall submit construction plans and specifications to NMED for the proposed system or process unit prior to the commencement of construction.</p> <p>In the event the permittee implements changes to the wastewater system authorized by this Discharge Permit that result in only a minor effect on the character of the discharge, the permittee shall report such changes (including the submission of record drawings, where applicable) as of January 1 and June 30 of each year to NMED.</p> <p>[Subsections A and C of 20.6.2.1202 NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]</p>
27.	<p>CIVIL PENALTIES - Any violation of the requirements and conditions of this Discharge Permit, including any failure to allow NMED staff to enter and inspect records or facilities, or any refusal or failure to provide NMED with records or information, may subject the permittee to a civil enforcement action. Pursuant to WQA 74-6-10(A) and (B), such action may include a compliance order requiring compliance immediately or in a specified time, assessing a civil penalty, modifying or terminating the Discharge Permit, or any combination of the foregoing; or an action in district court seeking injunctive relief, civil penalties, or both. Pursuant to WQA 74-6-10(C) and 74-6-10.1, civil penalties of up to \$15,000 per day of noncompliance may be assessed for each violation of the WQA 74-6-5, the WQCC Regulations, or this Discharge Permit, and civil penalties of up to \$10,000 per day of noncompliance may be assessed for each violation of any other provision of the WQA, or any regulation, standard, or order adopted pursuant to such other provision. In any action to enforce this Discharge Permit, the permittee waives any objection to the admissibility as evidence of any data generated pursuant to this Discharge Permit.</p> <p>[20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10 and 74-6-10.1]</p>
28.	CRIMINAL PENALTIES - No person shall:

#	Terms and Conditions
	<ul style="list-style-type: none"> • make any false material statement, representation, certification, or omission of material fact in an application, record, report, plan, or other document filed, submitted, or required to be maintained under the WQA; • falsify, tamper with, or render inaccurate any monitoring device, method, or record required to be maintained under the WQA; or • fail to monitor, sample, or report as required by a permit issued pursuant to a state or federal law or regulation. <p>Any person who knowingly violates or knowingly causes or allows another person to violate the requirements of this condition is guilty of a fourth degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who is convicted of a second or subsequent violation of the requirements of this condition is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition or knowingly causes another person to violate the requirements of this condition and thereby causes a substantial adverse environmental impact is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition and knows at the time of the violation that he is creating a substantial danger of death or serious bodily injury to any other person is guilty of a second degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15.</p> <p>[20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10.2.A through 74-6-10.2.F]</p>
29.	<p>COMPLIANCE with OTHER LAWS - Nothing in this Discharge Permit shall be construed in any way as relieving the permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders.</p> <p>[NMSA 1978, § 74-6-5.L]</p>
30.	<p>RIGHT to APPEAL - The permittee may file a petition for review before the WQCC on this Discharge Permit. Such petition shall be in writing to the WQCC within thirty days of the receipt of postal notice of this Discharge Permit and shall include a statement of the issues to be raised and the relief sought. Unless a timely petition for review is made, the decision of NMED shall be final and not subject to judicial review.</p> <p>[20.6.2.3112 NMAC, NMSA 1978, § 74-6-5.O]</p>
31.	<p>TRANSFER of DISCHARGE PERMIT - Prior to the transfer of any ownership, control, or possession of this facility or any portion thereof, the permittee shall:</p> <ul style="list-style-type: none"> • notify the proposed transferee in writing of the existence of this Discharge Permit; • include a copy of this Discharge Permit with the notice; and • deliver or send by certified mail to NMED a copy of the notification and proof that such notification has been received by the proposed transferee.

#	Terms and Conditions
	<p>Until both ownership and possession of the facility have been transferred to the transferee, the permittee shall continue to be responsible for any discharge from the facility.</p> <p>[20.6.2.3111 NMAC]</p>
32.	<p>PERMIT FEES - Payment of permit fees is due at the time of Discharge Permit approval. Permit fees shall be paid in a single payment or shall be paid in equal installments on a yearly basis over the term of the Discharge Permit. Single payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date. Initial installment payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date; subsequent installment payments shall be remitted to NMED no later than the anniversary of the Discharge Permit effective date.</p> <p>Permit fees are associated with <u>issuance</u> of this Discharge Permit. Nothing in this Discharge Permit shall be construed as relieving the permittee of the obligation to pay all permit fees assessed by NMED. A permittee that ceases discharging or does not commence discharging from the facility during the term of the Discharge Permit shall pay all permit fees assessed by NMED. An approved Discharge Permit shall be suspended or terminated if the facility fails to remit an installment payment by its due date.</p> <p>[Subsection F of 20.6.2.3114 NMAC, NMSA 1978, § 74-6-5.K]</p>

V. PERMIT TERM & SIGNATURE

EFFECTIVE DATE: May 30, 2017

TERM ENDS: May 29, 2022

[Subsection H of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.I]



MICHELLE HUNTER
Ground Water Quality Bureau
New Mexico Environment Department



New Mexico Environment Department Ground Water Quality Bureau Discharge Permit Summary

Facility Information

Facility Name DOE/NNSA Sandia National Laboratories
Discharge Permit Number DP-1845
Legally Responsible Party James Todd, Assistant Manager
DOE/Sandia National Laboratories
P.O. Box 5400
Albuquerque, NM 87185
(505) 845-6100

Treatment, Disposal and Site Information

Primary Waste Type Industrial
Facility Type DOE/Sandia National Laboratories

Treatment Methods

Type	Designation	Description & Comments
Injection Well	TAV-INJ1	Casing will connect mixing tank to convey substrate solution and bioaugmentation bacteria to subsurface.
Injection Well	TAV-INJ2	Casing will connect mixing tank to convey substrate solution and bioaugmentation bacteria to subsurface.
Injection Well	TAV-INJ3	Casing will connect mixing tank to convey substrate solution and bioaugmentation bacteria to subsurface.

Flow Metering Locations

Type	Designation	Description & Comments
Closed Pipe	Meter-1	In the gravity-injection line before injecting into the well

Ground Water Monitoring Locations

Type	Designation	Description & Comments
Monitoring Well	TAV-MW6	Monitoring well for injection well TAV-INJ1, 50 ft SE of TAV-INJ1
Monitoring Well	TAV-MW7	Monitoring well for injection well TAV-INJ1, 30 ft SE of TAV-INJ1
Monitoring Well	TAV-MW10	Monitoring well for injection well TAV-INJ2, 50 ft SE of TAV-INJ2
Monitoring Well	LWDS-MW-1	Monitoring well for injection well TAV-INJ3, 50 ft SE of TAV-INJ3

Depth-to-Ground Water 500 feet
Total Dissolved Solids (TDS) 423 mg/L



New Mexico Environment Department Ground Water Quality Bureau Discharge Permit Summary

Permit Information

Application Received	July 27, 2016
Public Notice Published	March 3, 2017
Discharge Permit Issued	May 30, 2017
Discharge Permit Term Ends	May 30, 2022
Permitted Discharge Volume	20,000 gallons per day

NMED Contact Information

Mailing Address	Ground Water Quality Bureau P.O. Box 5469 Santa Fe, New Mexico 87502-5469
GWQB Telephone Number	(505) 827-2900
NMED Lead Staff	Kellie Jones
Lead Staff Telephone Number	(505) 827-2949
Lead Staff Email	kellie.jones@state.nm.us